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Note to accompany a Drawing of the Milky Way. By Otto Boeddicker, Ph.D., Astronomer at the Earl of Rosse's Observatory at Birr Castle, Parsonstown.

(*Communicated by the Earl of Rosse.*)

The drawing of the Milky Way referred to was begun by me on October 24, 1884, and has occupied the greater part of my time and energy ever since. It was undertaken in the belief that an accurate representation of the galaxy, such as it appears to the naked eye, was an astronomical desideratum, and would be of some value for a variety of special investigations. In answer to a suggestion from your Secretary I propose now to give a short sketch of the history of the drawing.

First, I copied those maps of Argelander's *Uranometria Nova*, which should contain parts of the Milky Way, with the difference, however, that I indicated the stars by plain discs of different diameter only, in order to approach more nearly the actual appearance of the sky. Then, under exclusion of every trace of extraneous light, I examined the Milky Way, and as soon as I was satisfied that I had made out some feature, I turned on an incandescent lamp, and, by means of the stump, I inserted the detail observed in the map. This alternate seeing into darkness and on white paper (covered with black spots) proved a very great strain on the sight. Besides, as the eyes, after I had drawn the part observed, only very gradually regained their former sensitiveness, the work proceeded but slowly, three or four hours' drawing representing but a very small portion of it. As much as possible I drew the different sections only when they were near the meridian, in order to obtain the conditions most favourable for atmospheric transparency. This involved for the greater part of the Milky Way the necessity of my lying flat on my back (or nearly so) in the open air for hours together—a position which, especially on frosty nights, proved somewhat trying, for no amount of clothing was found sufficient to counteract the radiation of heat from the body.

The results were verified on consecutive nights, and further details added, so that a large number of nights was devoted to a single section. A further control was obtained by the overlapping of the sections, so that large portions of the Milky Way had to be drawn twice or even three times. This was in all cases done directly from the sky. In fact, the separate sections were never compared with each other until I had ceased to work at them. Next I constructed a large chart in stereographic projection down to 100° North Polar Distance, and inserted the parts of the Milky Way as furnished by the sections. This was required in order to deduce a true picture of the gradation of light in the Milky Way, or, in other words, a general uniform

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standard of luminosity, for up to this stage of the work each section, being drawn independently, contained its own standard. This construction of a large chart was comparatively easy, since, in consequence of the overlapping of the sections, a *tertium comparationis* for the brightness of the different regions was readily found.

The large map having been drawn, three different methods of controlling the gradation of light were employed. First, the different spots and parts of the Milky Way were numbered, and written down directly from the sky in order of brightness, those parts which were equal in brilliancy being specially singled out. Next, I noticed repeatedly the order in which the different portions of the galaxy appeared from first twilight to complete darkness, and, finally, the order in which they disappeared with the rising Moon. Some special precautions against errors had to be taken during the two last series of observations, which, however, I have not now time to particularise.

I delayed the combination of the sections into a general chart as long as possible, as—in order to exclude the possibility of any preconceived idea as to the structure of the Milky Way on my part—I wanted to remain as long as possible in ignorance of its appearance *as a whole.* For the same reason I avoided carefully all previous pictures; the most important of these—Heis's in his *Atlas Cœlestis Novus*—I never even saw until I had finally given up drawing. Purposely I do not say "until my drawing was finished," for I found the difficulty of producing a picture of the Milky Way so extremely great, that even now, after having spent five years on it, I have not yet the sensation of having done all I could and should have done. Yet I think that my errors will be rather those of omission than of commission, as I did my very best not to put down anything which I did not perceive over and over again as I finally drew it. But, of course, the hand may not always be able to follow the eye, and I appeal, therefore, to other observers to verify or correct my drawing.

The last stage of the work consisted in the construction of the three enlarged sections covering the whole of the Milky Way, and the general chart as they are here exhibited. On the latter the parallels and meridians were not indicated, as I wanted it to contain nothing but what is actually seen in the sky. The stars in these maps were taken from the Catalogue of the *Uranometria Nova.*

It is not my object here to enter into a long discussion of my drawing. But I may perhaps direct attention to a few special points.

The fainter detail given in my map becomes best visible if examined at a distance of from five to ten feet. The physiological reason for this appears to be that the contrast between the faint nebulosity and the surrounding white ground is lessened, the larger an area of our retina is covered by the image of this nebulosity. It would be hard to decide how far this

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detail follows any special law of grouping; yet the Milky Way seems to me pretty obviously to send out feelers (as it were) to nebulæ and clusters—for instance, to the nebula in *Andromeda*, and to *Præsepe* in *Cancer*. A similar tendency exists, perhaps, with regard to brighter stars. Further, I am struck with the tendency to duplication in Section III.*—a feature of which I only became aware when the general chart was constructed, and which is certainly not the outcome of any bias on my part. The larger stars seem to be surrounded by dark spaces. This cannot be altogether due to contrast, since in all these cases I employed special precautions—such as hiding the star by a small opaque object at a considerable distance from the eye—in order to get at the real appearance of the Milky Way in its immediate neighbourhood.

A comparison of my drawing with Heis's shows a striking absence of detail in the latter, no doubt owing to the fact that Heis did not devote sufficient time to it (that not being his main object), and also in consequence of his dividing the luminosity into five distinct degrees. This proceeding is not only contrary to nature, but becomes also a positive impediment in the way of any attempted imitation of it. Heis's drawing shows a broad region of faint luminosity surrounding the Milky Way proper. This I have not tried to imitate for two reasons. First, I am not sure that this luminosity is confined to the Milky Way. On the contrary, I perceive irregular patches of faint luminosity all over the sky—or, in other words, the background of the sky does not appear to me at all uniformly black. And, secondly, an attempt at drawing this luminosity would have thrown up, as it were, my scale of gradation to such an extent that pencil alone would have been insufficient to reproduce the most intense portions of the galaxy. In the same way all the lanes and rifts ought (probably with one or two exceptions) to be filled in with faint luminosity. I have tried to do this as much as possible, but may not have quite succeeded in rendering it conspicuous. Finally, I draw attention to the wisps of nebulous matter following rows of stars. It is not impossible that in some cases these wisps are due to the glare of the stars, or to irradiation on my retina; but, of course, according to my plan, I had to draw what I perceived. But it formed a part of my original programme to re-examine the Milky Way with a low-power telescope, in order to separate the optical from the physical luminosity. I now doubt much, however, whether I shall find time to do this, and I shall probably be obliged to leave this rather promising branch of the investigation to other observers.

In concluding these somewhat desultory remarks, I must not omit to state that one of the objects in exhibiting the drawing is to elicit opinions of astronomers as to the mode to be

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* [Section III. represents that portion of the Milky Way which is situated in the constellations *Perseus*, *Camelopardus*, *Taurus*, *Auriga*, *Orion*, *Monoceros*, *Gemini*, and *Canis Minor*.—Eds.]

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adopted for its reproduction, and also to ask whether a cheap reproduction of the star-charts alone (without the Milky Way) would be considered of any value for observatory use. I certainly found that the existence of such charts would have saved me a considerable amount of time and labour. May I, therefore, say that I should be very grateful for any general or special criticism, as well as for advice with regard to the best way to publish the maps?

A Discussion of Greenwich North Polar Distances of Polaris and other Stars, with reference to Corrections for Temperature and Humidity. By W. Grasett Thackeray.

(*Communicated by the Astronomer Royal.*)

The following paper is a continuation of one communicated to the Society last year, which will be published in vol. xlix. of the *Memoirs*, and is an endeavour to determine whether the discordances in the observed polar distances of *Polaris* arise from an imperfect correction for changes of temperature, or from the want of a correction for variations in the amount of humidity, or from some other cause.

The discordances here dealt with are the differences in the observed places of *Polaris* and *Polaris S.P.* as compared with the means of these observations grouped according to the readings of the exterior thermometer, or according to the value of humidity as given by the actual readings of the wet and dry bulb thermometer, taken from the photographic sheets, corresponding to the dates and times at which the observations of *Polaris* and *Polaris S.P.* were made.

The discordances for temperature depend on the observations made during the two periods, 1851–67, and 1877–84, and the discordances for humidity on the years 1877–84 only.

The following discordances, arranged according to temperature, are the result of a more careful discussion of the lower and higher temperatures, and an extension of the range of temperature in the latter direction, and represent errors of zenith distance.

Temperature	25°	30°·5	34°	38°	42°	46°	50°
	″	″	″	″	″	″	″
1851–67 1877–84	$+{\cdot}10_{93}$	$+{\cdot}16_{111}$	$+{\cdot}14_{249}$	$+{\cdot}18_{393}$	$+{\cdot}21_{402}$	$+{\cdot}06_{436}$	$+{\cdot}08_{437}$
Temperature	54°	58°	62°	67°·5	72°·2	77°·0	83°·0
	″	″	″	″	″	″	″
1851–67 1877–84	$+{\cdot}04_{366}$	$-{\cdot}09_{274}$	$-{\cdot}16_{274}$	$-{\cdot}32_{298}$	$-{\cdot}45_{130}$	$-{\cdot}60_{72}$	$-{\cdot}49_{21}$